

DEPARTMENT OF HEALTH

OF THE

CITY OF NEW YORK

NO. 15

REPRINT SERIES

FEBRUARY, 1914

DIRT SEDIMENT TESTING—A FACTOR IN OBTAINING CLEAN MILK

BY

M. C. SCHROEDER, M. D.

BUREAU OF LABORATORIES, DEPARTMENT OF HEALTH,
CITY OF NEW YORK



*Public health is purchasable. Within natural limitations
a community can determine its own death rate.*

DEPARTMENT OF HEALTH
OF THE
CITY OF NEW YORK

ERNST J. LEDERLE, PH.D.
COMMISSIONER OF HEALTH

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GENERAL MEDICAL OFFICER

EUGENE W. SCHEFFER
SECRETARY



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LETTERS OF TRANSMITTAL.

DEPARTMENT OF HEALTH OF THE CITY OF NEW YORK.

February 1, 1914.

To the Director of Laboratories:

SIR—I have the honor to submit herewith a paper on Dirt Sediment Testing As a Factor in Obtaining Clean Milk, and respectfully request that the same be approved for publication.

Respectfully,

M. C. SCHROEDER.

February 5, 1914.

To the Commissioner of Health:

SIR—I have the honor to transmit herewith a paper on Dirt Sediment Testing As a Factor in Obtaining Clean Milk, and to recommend that it be published in circular form for general distribution.

Respectfully,

W. H. PARK,

Director of Laboratories.

Approved for publication,

S. S. GOLDWATER,

Commissioner of Health.

February 15, 1914.

DIRT SEDIMENT TESTING — A FACTOR IN OBTAINING CLEAN MILK.

M. C. SCHROEDER, M. D.

Bureau of Laboratories, Department of Health, City of New York.

It is a well-established fact that filth in milk is, as a rule, associated with bacterial contamination. These bacteria are introduced into the milk by means of the particles of dust, manure, skin, hay, and feed to which they are attached, and milk thus contaminated may become a serious menace to health. Thus septic sore throats, tuberculosis, diarrhoeal diseases of infancy, dysentery, typhoid fever, etc., have been placed to milk and large epidemics of some of these diseases have shown the necessity of insisting upon the production of clean milk. Pasteurization will, it is true, destroy the specific disease bacteria, but it cannot make dirty milk wholesome. While a large proportion of the dirt may find its way into the milk from unclean cows, dirty or dusty barns, it must not be forgotten that some of it may be derived from the utensils into which the milk is placed, from the machinery through which it passes, and from unclean hands or clothing of those who handle the product. The insoluble dirt in milk can readily be estimated by straining through cotton or by the use of the centrifuge, while the soluble dirt passes through the cotton and may reveal its presence by a uniform discolorization.

RELATION OF AMOUNT OF DIRT TO NUMBER OF BACTERIA.

Some forms of dirt, like coal dust, are almost sterile, while others, like manure, are alive with bacteria. A large number of examinations have shown that the amount of dirt approximates the number of bacteria in fresh unfiltered milk tested at the time of production. Bacteria rapidly reproduce themselves in milk kept at a temperature above 50° F., so that a fairly clean milk according to the sediment test may, after twelve or more hours, have a high bacterial count. Any admixture of old milk or careless handling or straining through unclean materials may add millions of bacteria to milk which was originally of the best quality.

Milk which has not been strained previously through cotton or close filters, may be tested for the amount of sediment which it contains. This testing may be done at the creameries and affords a rapid way of ascertaining approximately the amount and character of the contamination to which the milk has been subjected at the time of milking. The use of the sediment test in the city will show the original dirt, plus the contamination which it may have acquired during the process of handling, at the creameries or bottling plants.

Numerous methods have been devised during the last fifteen years but no one method has as yet been generally adopted.

METHODS OF OBTAINING SEDIMENT.

The methods of obtaining the sediment in milk may be divided into two groups:—

Group 1. Sediment obtained by gravity filtration.

Group 2. Sediment obtained by centrifugalization.

Group I. (a) *Type in which the sediment is obtained by gravity filtration.*

Conn's Filter Paper Method.

The Lorenz or Wisconsin Tester.

The Stewart Tester.

The Gerber Tester.

The Schroeder Tester, or Multiple Filter.

(b) *Type in which pressure or suction is used.*

The Lorenz Improved.

The Wizard.

The Gooch Crucible.

Group II. *Type in which the sediment is obtained by means of the centrifuge.*

The Babcock.

The Gerber.

The Stewart Slack.

Conn's Centrifugal Method.

CONN'S GRAVITY FILTER PAPER METHOD.

By this method the sediment is obtained by allowing the milk to stand several hours. After the removal of the supernatant milk, salt solution is added and the sediment washed. This procedure is repeated a number of times, and the sediment is finally collected upon dried and weighed filter papers. Finally the paper with the sediment is dried and weighed and the amount of sediment estimated.

THE LORENZ MODEL OR WISCONSIN DIRT TESTER.

The Lorenz Model or Wisconsin Dirt Tester (see Fig. 1) is composed of two cylinders made of copper, one within the other. The outer cylinder has a narrow piece of tubing fitted into the lower portion which is so arranged that it may be connected by means of rubber tubing with a hot water supply.

The water jacket was found necessary owing to the fact that cold or icy milk does not filter rapidly. Under these conditions there is apt to be a deposit of cream upon the surface of the cotton. This cream not only

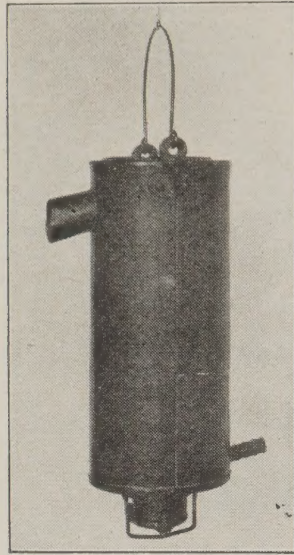


Fig. 1.—Lorenz Model Dirt Tester. (Courtesy of Lorenz Model Co.)

interferes with the passage of the milk, but with a proper estimate of the amount of dirt sediment.

When the filter is to be used, a disc made of absorbent cotton is placed within the cap. The inlet tube is attached by means of rubber tubing to a hot water supply and the space between the cylinders is filled with hot water which flows off through the upper outlet. A pint of milk is poured into the inner cylinder and is filtered through the cotton.

STEWART TESTER.

The Stewart Tester consists of two or more straight tubes fitted with strainers at one end. These tubes pass through a metal box. The air in the interior of the box is heated by means of an alcohol flame which warms the tubes holding the milk.

THE GERBER TESTER.

The Gerber Tester is shown in Fig. 2.

It consists of a cylinder with sloping sides fitted with a special cap at its

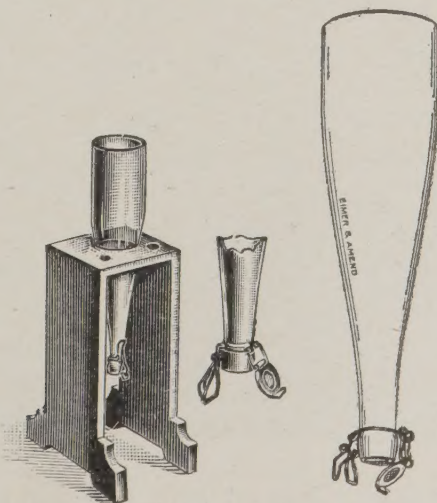


Fig. 2.—Gerber Filter. (Courtesy of Eimer & Amend.)

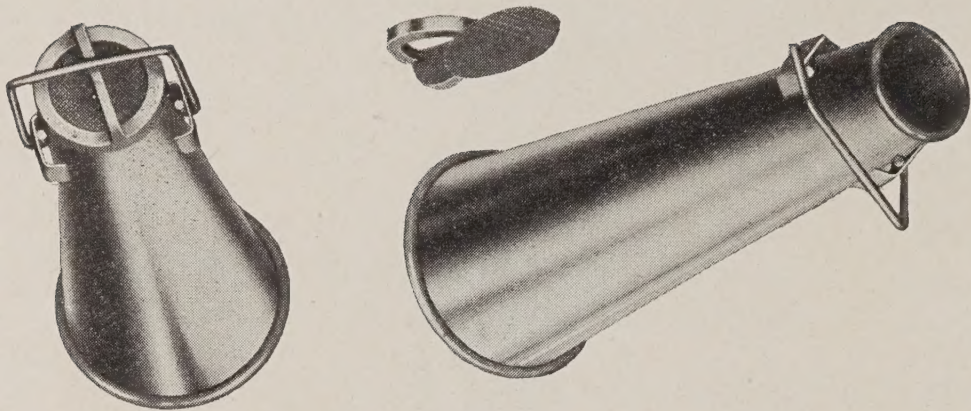


Fig. 3.—Individual Testers, Schroeder Filter. (Courtesy C. Vail.)

narrowed end. The sample is poured into the container and this is then set in the rack.

THE SCHROEDER FILTER.

The Schroeder Filter is a modification of the Lorenz Filter and is adapted for use in creameries where speed is an essential feature of the work.

It consists of a series of individual testers.

A hot water tank or jacket.

A lamp for heating the water.

A reservoir or carrying case.

The individual tester consists of a seamless cylinder of spun copper and fitted at the narrow end with a skeleton brass cap containing the brass disc and held in place by a copper catch (see Fig 3).

The hot water jacket is a covered box-shaped tank having ten cone-shaped, hollow cylinders passing through its entire depth for the reception of the

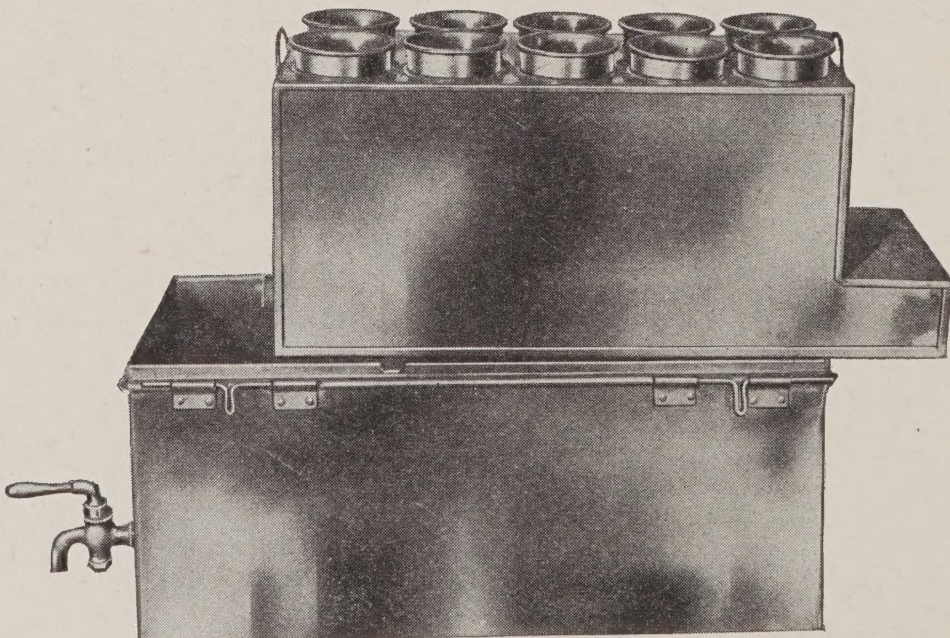


Fig. 4.—Water Jacket for Schroeder Filter set over carrying case or reservoir. (Courtesy of C. Vail.)

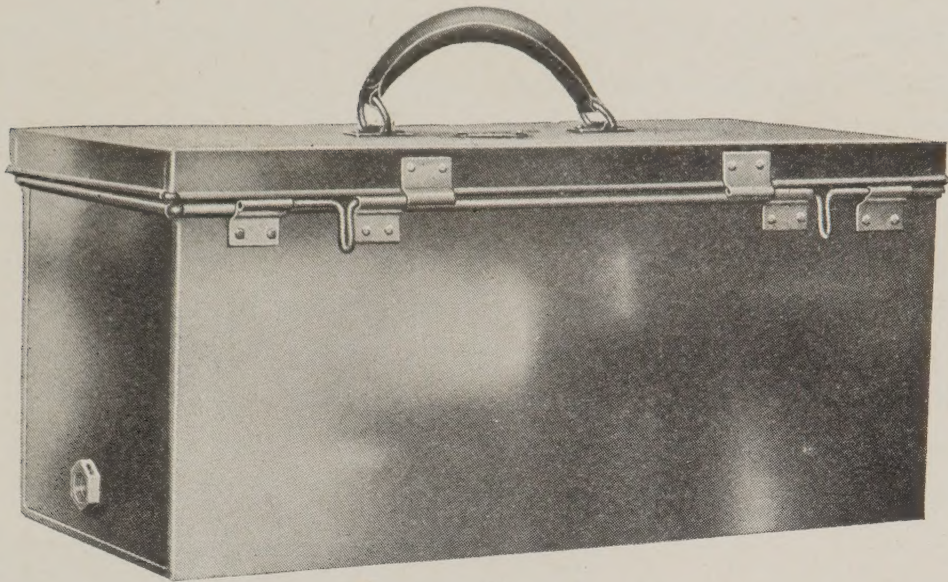


Fig. 5.—Carrying case and reservoir for Schroeder Filter. (Courtesy C. Vail.)

individual testers. It is provided with a water inlet and outlet and a steam vent. A covered extension serves for the direct application of heat. A movable brass bar is fastened to the under surface to act as a support for the jacket when the tester is in use (see Fig. 4).

Lamp for use with the tester. The alcohol lamp consists of a powerful burner, regulated by a screw, so that the flame may be raised or lowered and a large reservoir for alcohol. The reservoir is fitted at each end with a shoulder piece having a turned edge upon its upper side. This edge

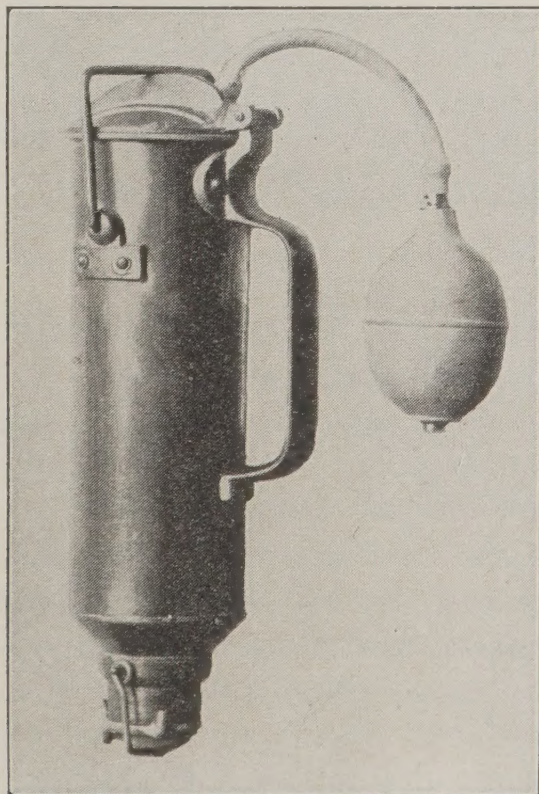


Fig. 6.—Improved Wisconsin Tester. (Courtesy of Lorenz Model Co.)

slips over the corresponding ridge on the extension and holds the lamp in place when the apparatus is in use.

Carrying case or reservoir (see Fig. 5). The case is made of light copper. The cover is hinged and closes anteriorly with a copper wire bolt as shown in the illustration. For convenience in carrying, a leather handle is attached to the cover by reinforced metal strips. The case also acts as a reservoir for the milk flowing through the filters. The milk is drawn off through the small detachable faucet shown in the illustration, directly into a milk can. This can may be set in a box of ice, thus cooling the milk and obviating any loss of the product.

It is easily adaptable for use in large dairies or creameries and can be

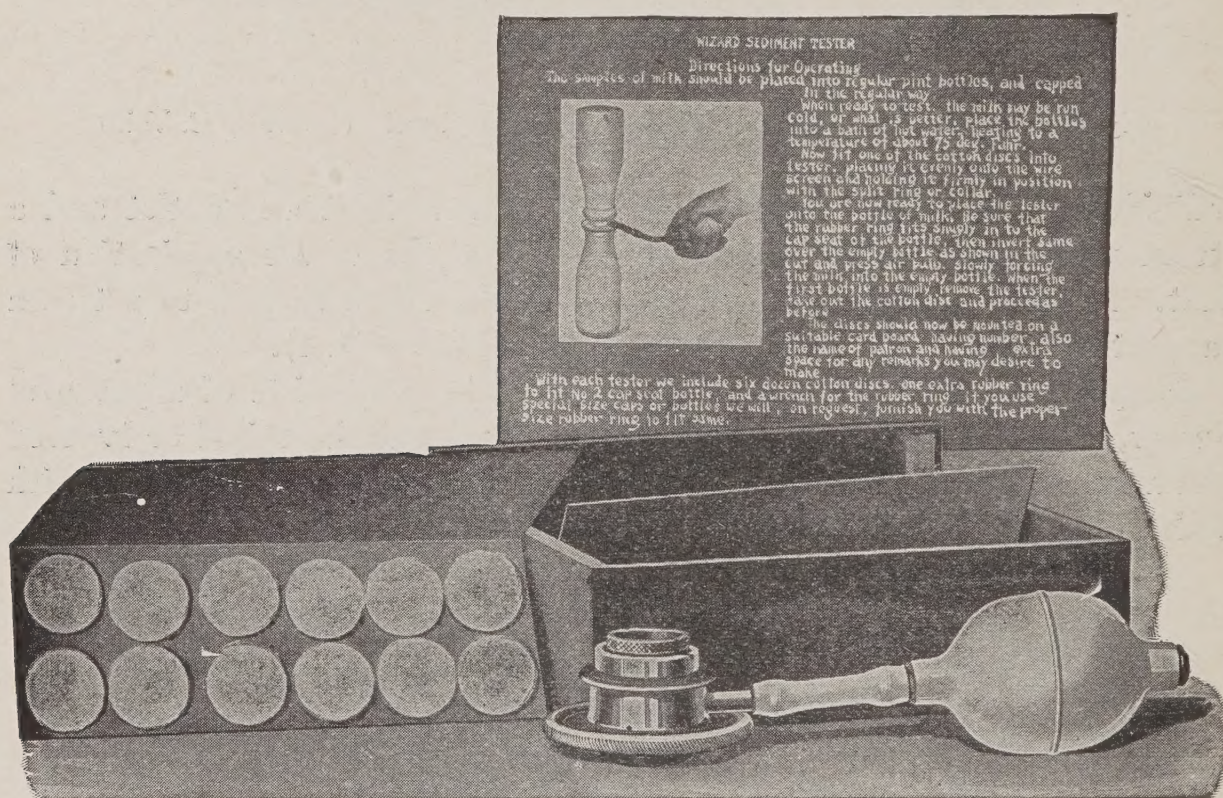


Fig. 7.—Wizard Tester. (Courtesy of Creamery Pkg. Co.)

made a permanent fixture. In this case, the cups may be made quart or pint size and numbered. The hot water jacket may be coupled up with a steam jet and the reservoir connected with the receiving vat or mixing tank. If the apparatus is placed in the receiving room, the milk may be taken from the cans of the individual dairymen as they deliver the milk and then poured into the numbered cups. The milk filters through into the reservoir and may be drawn off from time to time and thus no loss or waste entailed. By the time the last dairyman has delivered his milk, the other samples have passed the filters and all the cottons are ready for comparison with the gauge. This apparatus was devised with the hope of making the testing for dirt more practicable, is not patented and can be made by any who desire to manufacture it.

TYPE IN WHICH PRESSURE OR SUCTION IS USED.

Wisconsin Improved Tester. This filter is similar to the Lorenz Model shown in Group I with the addition of a close-fitting lid and pressure bulb, but without the water jacket. The pressure increases the rapidity of the flow of the milk (see Fig. 6).

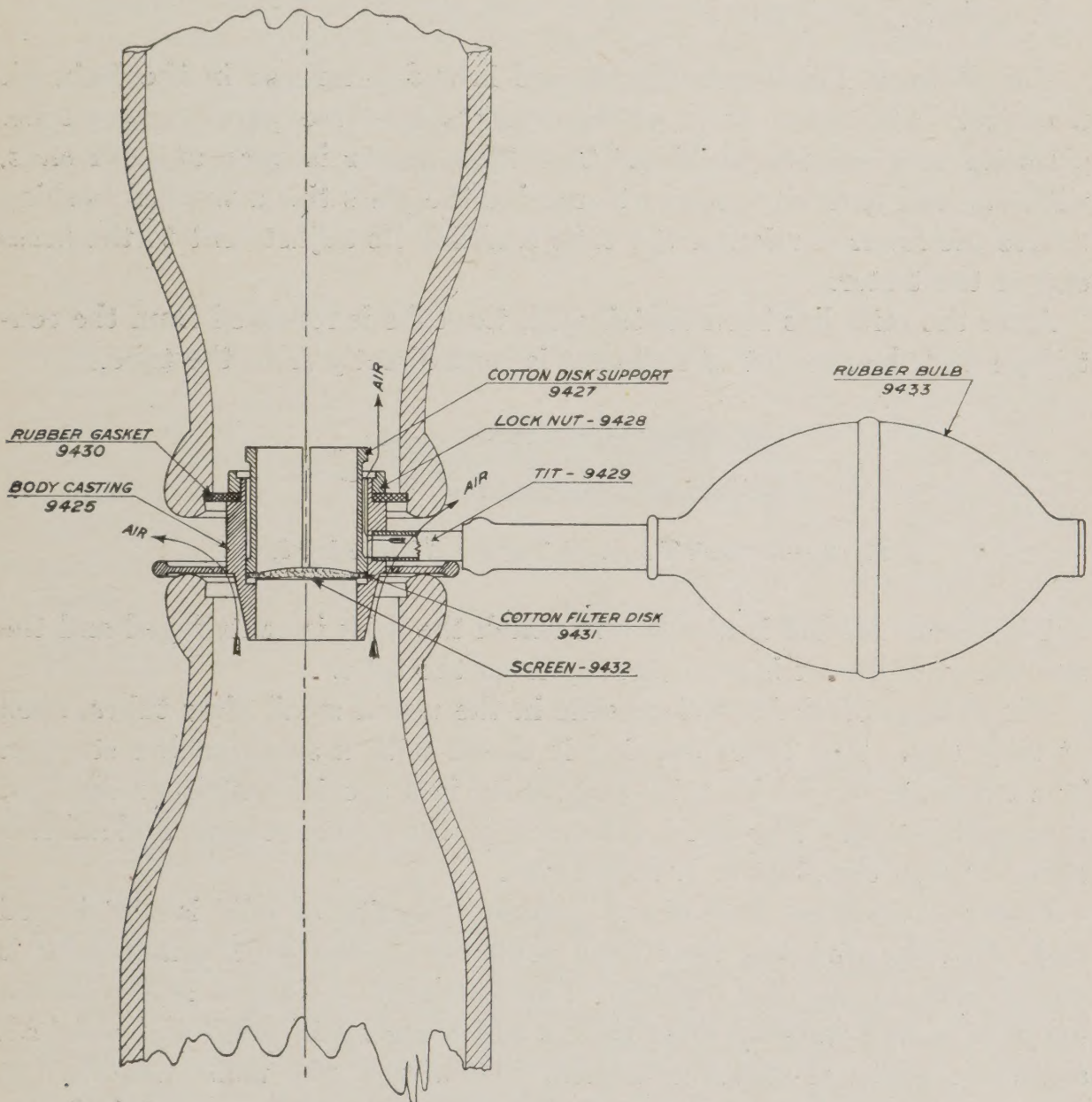


Fig. 7a.—Diagram of Wizard Tester. (Courtesy of Creamery Pkg. Co.)

The Gooch Crucible Filter. A cotton disc is placed inside the Gooch Crucible and the crucible set in the neck of the Woulf bottle. The side-arm is then connected with a pressure pump and the milk is poured into the crucible and drawn through by means of suction.

The Wizard Tester is useful in ascertaining the amount of sediment in milk as offered for sale (see Figs. 7 and 7a). The air pump is necessary to prevent the development of a partial vacuum. (7a shows a diagram illustrating the parts of the tester.)

TYPE IN WHICH SEDIMENT IS OBTAINED BY MEANS OF THE CENTRIFUGE.

Considering the second group briefly, we have

1. Babcock Method.
2. Gerber Method.
3. Stewart-Slack Method.
4. Conn's Centrifugal Method.

The Babcock Tubes (see Fig. 8) are intended for use in the Babcock machine. The tube, as a whole, consists of three parts:—glass tube, glass tip and wooden bushing. The tube proper is open at both ends, with one end carefully ground to receive the glass tip; a wooden bushing covers the lower portion of the tube enabling its adjustment to the brass cup of the tester.

After the milk has been centrifuged, the tube is removed from the centrifuge and the amount of sediment is read directly from the tube.



Fig. 8.—Babcock Tubes. (Courtesy of Biesiecker & Co.)

The Gerber Method is also one in which the milk is centrifuged and the amount of sediment is read directly from the tube.

The Stewart-Slack Method consists in the use of small glass tubes, open at each end. The lower opening is closed with a small rubber stopper. The tubes are filled with milk and placed in a special centrifuge disc and then centrifuged. The dirt is thrown upon the rubber stopper and adheres thereto when the stopper is withdrawn.

Conn's Centrifugal Method. A definite quantity of milk is centrifuged and after the dirt has thus been sedimented, the supernatant milk is removed by means of a pipette. The sediment is washed and collected upon dried and weighed filter papers which are again dried and weighed, and the amount of dirt determined. To obtain the moist weight, it is necessary to multiply the figures obtained at the end, by a certain factor which will reduce it to the weight of ordinary moist material. This, of course, will be a variable one, according to the material of which the dirt is composed but a rough approximation may be obtained by multiplying the dry weight by the factor of 7 which will produce a result not very far out of the way.

USE OF THE TEST FOR SEDIMENT IN MILK.

In order to determine how much the sediment test was being used and what value was placed upon the test, a questionnaire comprising a number

of questions was sent to health officials of cities, to agricultural stations and to milk dealers throughout the country.

“Do you use any test for ascertaining the amount of dirt in milk? If so, what type? How often?

Where is milk tested, at creameries as received from individual dairymen, or city plants, railroad stations, wagons, etc.?

Do you grade the amount of dirt found and are the results recorded and posted up so that the dairymen may see how their milk runs?

Of what value do you consider the test?”

In response, we received 106 replies and the results are shown in Table I.

TABLE 1.
TABULATION OF REPLIES RECEIVED.

	Replies Received.	Using Test.	Not using Test.
Health Officials.....	36	30	6
City Milk Dealers.....	29	9	20
Dealers not in New York City.....	37	18	19
Not Signed	4	—	4
Totals.....	106	57	49

Of the total number of replies received 57, or 53.7 per cent. of the writers, state that they are using the test, 46.2 per cent. are not using the test. Among this number are some who are making preparations to use the test, being convinced of its value.

The replies in detail are given in Table 2.

While the replies from the questionnaire were being received and tabulated, the methods used in sediment testing were subjected to a critical study to see if any changes were required in the tester used by the Department and also to formulate some plan to make the testing of milk and recording of sediment cottons available for all creameries shipping milk to New York. A large milk company placed one of its creameries at our disposal and experimental work started in the latter part of July, 1913.

The results obtained are given in the succeeding paragraphs.

TEST TO ASCERTAIN THE FACTORS INFLUENCING GRAVITY FILTRATION.

In this experiment, 416 samples of milk were tested. The points considered were the temperature, the time the milk took in passing through the filter cotton, the amount of fat and the total solids. The temperatures most favorable to filtration were from 40 to 80°. An analysis of the time element gives the results shown in Table 3.

TABLE 2.
TABULATION OF RESULTS OBTAINED FROM QUESTIONNAIRE.

Number of Question.	Question.	Replies.	Total.
1.	Do you use Sediment Test?	Using test 57 Not using test 49	106
2.	Type of Tester.	Wisconsin 21 Wizard 10 Stewart-Slack 2 Gerber 1 Babcock 1 Stewart 1 Gooch Crucible 3 Schroeder 3 Jones 1 Not stated 6 Miscellaneous 8 —	57
3.	At what places is milk tested?	Tested at country creameries 32 Tested at city plants 18 Tested at wagons 1 Tested at railroad depots 1 Tested at stores 1 Not stated 4	57
4.	Regularity with which test is used?	Testing daily 10 Monthly 13 Testing weekly 5 Bi-monthly 3 Testing bi-weekly 2 Quarterly 1 Testing bi-yearly 1 Testing at irregular intervals 9 Not stating action taken 13	57
5.	Concerning the grading of the sediment.	Number grading sediment 13 Number not grading sediment 30 Number not stating action taken 14	57
6.	Tests recorded.	Number recording results 34 Number not recording results 7 Number not stating action taken 16	57
7.	Anent the posting of results.	*Number posting results 21 Number not posting results 22 Number not stating action taken 14	57
9.	Concerning the value of test.	Number stating that middlemen, shippers and dairymen were notified — Number considering test of good value 37 Number considering test of slight value 1 Number considering test of no value 2 Number not stating opinion but using test 17	43 57

*A number considered it unwise to post results owing to competition.

TABLE 3.

TABLE SHOWING RAPIDITY OF FLOW OF MILK THROUGH FILTER COTTON.

46 or 11.0%	filtered through the cotton in less than 1 minute.
287 or 68.9%	filtered through the cotton in from 1 to 3 minutes.
31 or 7.4%	filtered through the cotton in from 3 to 5 minutes.
18 or 4.3%	filtered through the cotton in from 5 to 10 minutes.
17 or 4.0%	filtered through the cotton in from 10 to 60 minutes.
17 or 4.0%	filtered through the cotton in over 60 minutes.

It will be seen that over 87 per cent. of the samples filtered through the cottons in less than 5 minutes.

Judged from the data obtained from the chemical tests, the filtration process did not seem to be affected by the fat content, total solids, or the amount of sediment present in the form of visible dirt. A large excess of leucocytes or epithelial cells tended to retard the filtration.

A number of tests were made on colostrum and stripper milks, but we found that these milks, as a rule, filtered through quite readily.

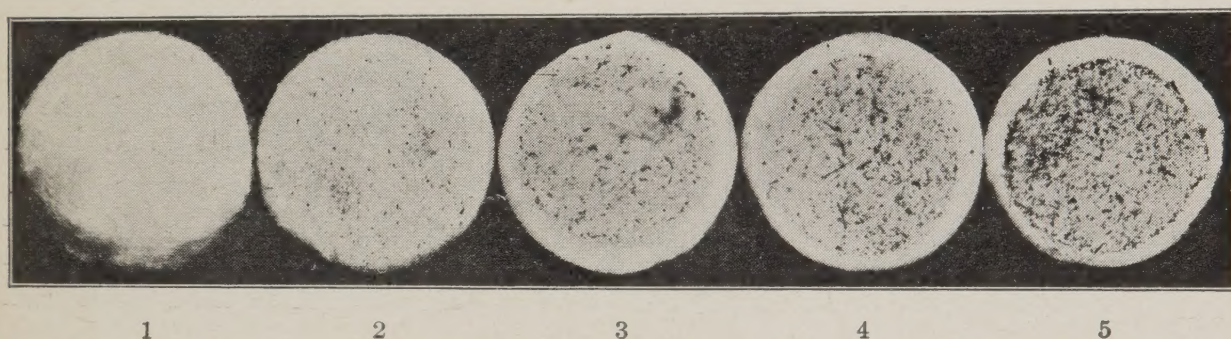


Fig. 9.

According to Baer, the sediment test may also be applied to cream. His method is to dilute the sweet cream with an equal amount of warm water. In testing sour cream, it is necessary to dissolve the curd. This may be done by the addition of an alkaline solution made by dissolving a small can of lye in 2 quarts of water; when cool, the mixture is strained, bottled and corked. The amount of solution necessary is determined by the acidity of the sample. Cream having 0.5 per cent. or 0.6 per cent. acidity, will require about 30 cc. of the solution. Sour cream must be diluted in the same manner as sweet cream.

METHOD OF READING RESULTS OF FILTER TEST.

Owing to the difficulties of making comparative readings of the amount of sediment collected upon filter cottons, gauges have been devised. The one elaborated by us is shown in Fig. 9. This gauge represents the amount of dirt obtained by filtering liter lots of milk to which had been added

METHOD OF RECORDING THE TESTS.

A number of cities and dealers have various ways of bringing the results of the tests to the attention of the dairymen. Some simply place the filter cottons upon board, and hang this so that each farmer may see the result of the test of his milk.

Description of Board. A smooth board is chosen and painted white and moulding is attached to three sides so as to form a frame and groove. The groove is intended for the reception of a glass plate. The surface of the board is divided into spaces having an area of 2 square inches. These squares are numbered with the patron's number and serve for the reception

Department of Health
The City of New York

Creamery at _____ Date _____

Operator _____

Art. Bact. Seals _____ Art. Sediment Seals _____

Sample taken Am Am Air Temp. Fahr° _____

Name	Soil mud etc	Ice used	Type milk	Temp.	Sample no.	Sedi. mud	Bacterial Count

Front.

Name	Soil mud etc	Ice used	Type milk	Temp.	Sample no.	Sedi. mud	Bacterial Count.

Back.

Fig. 11.—Card used for Recording Data Obtained in Country.

of the cotton from the test. The cotton is attached by means of a tiny tack or mucilage. The glass is then slipped into the groove, and serves to protect the cottons from dust.

Others attach the filter cottons to cards and send them to dairymen with admonitions. A sample letter and card are shown.

AUBURN, MAINE.

Dear Sir:

We enclose a cotton disc containing the dirt strained from a half pint of your milk.
If the question of dirty milk were simply one of appearance, a finer or thicker strainer would solve the problem. But each particle of dirt falling into the milk carries with it a great number of bacteria which multiply very rapidly in warm milk. These bacteria cause the changes which occur in milk. Clean milk keeps longer than dirty milk because it con-

tains fewer bacteria. The solid dirt in milk can be strained out, but bacteria are still left behind to do their mischief. Consequently, the remedies for dirty milk are clean cows (the most important—three quarters of the dirt comes from the cows), clean tie-up (tight ceiling over tie-up to keep the chaff from falling), careful handling, etc.

Your milk will be examined again and report sent.

Respectfully,

TURNER CENTRE DAIRYING ASS'N.

SAMPLE CARD

This represents the sediment in one pint of your milk received on

.....

clean

fairly clean

dirty

filthy

Remarks.....

.....

.....

.....

.....

THE BELLE-VERNON MAPES DAIRY CO.

One Health Board cuts the discs in half and retaining one half, sends the duplicate to the dairyman delivering milk.

METHOD OF RECORDING RESULTS.

The cottons may be pasted into a loose-leaf ledger and thus a permanent original record kept of each test and the improvement or deterioration noted, or the results only may be entered upon an individual card and indexed. They may be also numbered and filed in thin metal trays.

The method used by New York City at present is as follows:—

The country inspector visits the creamery and takes one pint of milk from each patron. The milk is then subjected to the filter test. The cottons are sprayed with a strong solution of bichloride and partially dried.

The tests are then cut in half, one half is left with the creamery manager, the second half is placed in a small glassine envelope.

The small envelopes are then placed in a stout manila envelope and together with the special record sheet (see Fig. 10) sent by mail to the Bacteriological Laboratory for comparison with the gauge and recording the results. The Inspector also secures the data shown on the card illustrated

12 F-1912

22-130, '12, 25,000 (P)

Department of Health, The City of New York
DIVISION OF FOOD INSPECTION

Date.....Time.....A. P. M. Air Temperature.....

Inspection No.....Sample Nos.....

Taken from.....Business.....

Address.....Store. Wagon. Permit No.....

Shipped from.....Taken at.....

How Labelled.....

.....

Pasteurized.....Where.....Time.....

Containers and Utensils Clean.....Containers Sterilized.....

Containers Sealed.....How Iced.....

Samples Delivered at Laboratory.....

Inspector of Foods (Milk)

Front.

[illegible]

Examined by _____ Approved _____
Bacteriologist Director of Laboratories

Remarks _____

Chief Inspector Division of Food

Back.

Fig. 12.—Card used by City Inspector.

(see Fig. 11). The Inspector who makes the sediment test in the city, records his data on the small card shown (see Fig. 12),—these cards may also be used if bacterial samples are to be taken in conjunction with the sediment test.

PUBLICATIONS
OF THE DEPARTMENT OF HEALTH
OF THE CITY OF NEW YORK

1. **Annual Report.** A statistical and descriptive account of the year's work of the entire Department.
2. **Quarterly Report.** Vital statistics and work performed for the periods ending March 31st, June 30th, September 30th and December 31st. This report is published in the City Record, the official daily publication of the government of New York City. The small edition of reprints which was formerly issued has recently been discontinued.
3. **Monthly Bulletin.** Established in January, 1911. The Bulletin contains summary tables of vital statistics for the preceding month, together with descriptive articles and notes intended for the instruction of the public and for the information of physicians and others concerned in public health work, to whom an account of the methods, aims and accomplishments of this Department may be of interest. The Bulletin is mailed without charge to a restricted list of libraries, publication offices, physicians, public health officials and others especially interested.
4. **Weekly Bulletin.** The Department has published a weekly summary of vital statistics for many years. This is printed in the City Record and a small edition of reprints is available for mailing to public health officials and others particularly interested.
5. **Collected Studies from the Research Laboratory.** An annual collection of scientific papers representing the work done at the bacteriological laboratories for the year.
6. **Monograph Series.** A recently established series of special papers by officials or employees of the Department, each dealing with some particular problem or phase of the Department's work. These papers appear from time to time, at no specified interval.
7. **Reprint Series.** The Department occasionally reprints at its own expense and distributes shorter papers published by its officers or employees in medical and other scientific journals. Such papers are published in a standard serial form, with a list of those available for distribution.
8. **Other Publications.** The Department of Health also publishes numerous pamphlets of rules and regulations, methods of procedure, instructions and advice to the public on particular subjects, etc., which are not classified or listed.

The Department will enter into exchange of publications with public health, medical and scientific organizations, societies, laboratories, journals and authors. Applications for publications should be addressed to the Secretary, Department of Health, Corner of Center and Walker Streets, New York City.

REPRINT SERIES

- No. 1. Pasteurization of Milk with Suggestions as to Methods and Apparatus to Be Employed. By Charles H. Kilbourne, Supervising Inspector of Foods in Charge of Pasteurizing Plants.
- No. 2. The Sanitary Control of Local Milk Supplies through Local Official Agencies. By Ernst J. Lederle, Ph. D., Commissioner of Health.
- No. 3. The Rural Origin of Much of the Typhoid Fever of Large Cities, and the Need of Reorganizing Rural Public Health Administration. By Charles Frederick Bolduan, M. D., Assistant to the General Medical Officer.
- No. 4. A Plan for the Reorganization of the Public Health Service of the State of New York. By Charles F. Bolduan, M. D., Assistant to the General Medical Officer.
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- No. 7. The Municipal Sanatorium of Otisville. By Hermann M. Biggs, M. D., General Medical Officer.
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- No. 9. The Contagious Disease Hospitals of New York City. By Robert J. Wilson, M. D., Superintendent of Hospitals.
- No. 10. The Function of Municipal Authorities in the Control and Improvement of Food Supplies. By Ernst J. Lederle, Ph. D., Commissioner of Health.
- No. 11. Venereal Diseases—The Relation of the Public Authorities to Their Control. By Charles F. Bolduan, Assistant to the General Medical Officer.
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- No. 13. Prejudices and Superstitions Met With in Medical School Inspection. By Jacob Sobel, M. D., Borough Chief, Bureau of Child Hygiene.
- No. 14. Four Years in the Department of Health. By Ernst J. Lederle, Ph. D., Commissioner of Health.
- No. 15. Dirt Sediment Testing a Factor in obtaining clean Milk. By M. C. Schroeder, M. D., Assistant Director, Bureau of Laboratories.